CSO Holiday Workshop

Coding, Computer Science & Computational Thinking

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About Me

• Studied Software Engineering 2010 - 2014

• Now in School of Education, studying PhD about Teacher Professional Learning (TPL)

• Interested in implementation of Digital Technologies curriculum

• Involved in TPL workshops in this area since 2013

• And you?
Session Schedule

- Presentation: Coding, Computer Science & Computational Thinking (~20 minutes)
- Activity 1: Teaching Computer Science without a Computer (~40 minutes)
- Activity 2: Visual Programming with Scratch (~1 hour)
Coding, Computer Science & Computational Thinking
What is Coding?

• Coding, or computer programming\(^1\), is the act of writing instructions for a computer in a programming language.

• Computers can only understand specific and precise instructions, generally can't deal with ambiguity.

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What is Coding?

- Code should be written for humans first and computers second.
- Visual Programming Languages, such as Scratch, allow anyone to get started Coding without knowing particular keywords and syntax.
- Encouraging students to learn how to code has become a global movement, e.g. the Hour of Code.
Why teach Coding in K - 12?

1. To prepare students for their future careers
2. To help students understand the "digital world"
3. To allow students to formally define processes as a way to gain understanding about concepts
4. To give students another way to create and express themselves

1. is often emphasised but the other 3 are just as, if not more, important
What is Computer Science?

- Computer Science is a field which encompasses a variety of disciplines, e.g. Artificial Intelligence
- Despite the name - not just about computers! At its core, CS is about problem solving
- Writing Algorithms, step-by-step procedures that can be performed by a computer, are central to CS
- Some disciplines of CS are very close to Mathematics and may not involve any coding at all!
What is Computer Science?

What would we like our children - the general public of the future - to learn about computer science in schools? We need to do away with the myth that computer science is about computers. **Computer science is no more about computers than astronomy is about telescopes, biology is about microscopes or chemistry is about beakers and test tubes. Science is not about tools, it is about how we use them and what we find out when we do.**

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Where do Computer Scientists work?

• At software companies, like Google and Microsoft
• At the University of Newcastle, supporting Education and Psychology researchers
• At the Hunter Medical Research Institute, working with Biologists and Medical researchers
• Lots of other different research areas and industries!\(^3\)

\(^3\) http://www.refractionmedia.com.au/careerswithcode/
What is Computational Thinking?

• "Thinking like a Computer Scientist"\(^4\)

• A way of approaching solving problems: **not** thinking about or like a computer

• "Most obviously apparent, and probably most effectively learned, through the rigorous, creative processes of writing code."\(^5\)

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\(^4\) https://www.cs.cmu.edu/~15110-s13/Wing06-ct.pdf

\(^5\) http://barefootcas.org.uk/barefoot-primary-computing-resources/concepts/computational-thinking/
Core Computational Thinking Concepts

• **Logical Reasoning:** predicting and analysing
• **Algorithms:** making steps and rules
• **Decomposition:** breaking down into parts
• **Patterns:** spotting & using similarities
• **Abstraction:** removing unnecessary detail
• **Evaluation:** making judgement

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6 http://barefootcas.org.uk/barefoot-primary-computing-resources/concepts/computational-thinking/
Computational Thinking in K - 12

- US, UK, New Zealand and others have introduced compulsory curricula with focus on CT in both primary and high school
- In Australia, Digital Technologies endorsed as part of national curriculum
- In NSW, BOSTES recommends integrating Coding and CT across the syllabuses
Summary

- *Computational Thinking* has been proposed as a problem solving process that can be beneficial for all students.
- Computer Scientists are primarily problem solvers that work in a variety of industries and research areas.
- After analysing a problem, Computer Scientists usually attempt to solve the problem by coding a solution to the problem.